Darwin's wind hypothesis

Riba, Miquel; Mayol, Maria; Giles, Barbara E.; Ronce, Ophelie; Imbert, Eric; van der Velde, Marco; Chauvet, Stephanie; Ericson, Lars; Bijlsma, R.; Vosman, Ben

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Supporting information – Notes S1, Tables S1 and S2 and legends to Figs S1–S3

Notes S1 In the Mediterranean Spanish and French regions, *M. muralis* is almost exclusively restricted to open and humid habitats in mountain valleys, forming well-defined clusters along permanent river banks and nearby gaps within evergreen or deciduous forest and scrublands. In its southernmost locations it is even more restricted to small vegetation gaps near water sources. Fragmentation in its southern range is thus both associated with limited moisture availability and closure of vegetation following forest and scrub re-growth after abandonment of forest management practices. Distances between Spanish landscapes varied between 10 and 200 km, whereas the French landscapes were located 9–62 km apart.

Within The Netherlands, the species is also found in half-shaded habitats such as open woods and wood margins, but also in more exposed and places, such as rock outcrops and urban areas (e.g. within cities and cemeteries). Distances between the selected landscapes in this region varied from 33 to 240 Km.

The Swedish landscapes are located around the Bay of Gävle in the Bothnian Sea. *M. muralis* sites range from open and exposed rocky shores, through brook sides to more permanent herb-rich deciduous or mixed forests. These sites occur primarily on the islands and coastlines, but also inland, in smaller depressions in the terrain surrounded by unsuitable acid soils dominated by coniferous forests. Three of the eight landscapes were islands (EGD, GRD and LOV), two were coastal (SUT and BIL) and three inland (KYR, LOT and VAS). Distances between landscapes varied between 5 and 25 km.

Individual plants disperse their seeds during 3–4 wk depending on their size and climatic conditions. Seed dispersal takes place from mid June in the hottest and driest sites (southernmost Spanish populations), to mid September in some Swedish populations at high latitudes.

Table S1 Location, names and main characteristics of European landscapes selected. LO: percentage of the area occupied by *M. muralis* patches. See Material and Methods for further explanation.

Country	Landscape (code)	Location	LO (landscape occupancy, %)	Total # flowering plants	# (sampled plants)	Site habitat
Spain	Basiet (BAS)	40°49' N 00°21' E	0.0001	5	2	Water spring in pine-oak forest
	Balma (BAL)	42°15' N 01°44' E	0.1845	1128	54	Along stream, gaps in pine-beech forest
	Burgar (BUR)	40°39' N 00°33' E	0.0024	33	12	Water spring in evergreen-oak and pine forest
	Cargol (CAR)	40°49' N 00°22' E	0.0066	52	20	Along stream in pine forest and scrubland
	Castellfollit (CFT)	41°19' N 01°02' E	0.1474	4628	122	River bank, gaps in oak-pine forest
	Collformic (COL)	41°48' N 02°21' E	0.0226	139	29	Spring, gaps in oak-beech forest
	Fou (FOU)	40°45' N 00°16' E	0.0215	106	17	Along stream in pine-oak forest
	Vidalbar (VID)	41°17' N 00°50' E	0.0036	107	16	Ravine in pine-oak forest

France	Graisessac (GRA)	43°41' N 03°05' E	0.0094	250	12	Factory ruin in chestnut forest
	Natges (NAT)	43°50' N 03°35' E	0.0208	75	23	Path in oak forest
	Radier (RAD)	43°53' N 03°30' E	0.0360	75	25	Along stream in riparian-oak forest
	Salesse (SAL)	43°40' N 02°51' E	0.0433	160	17	Forest path in managed fir forest
Netherlands	Bergen (BG)	52°40' N 04°40' E	0.1061	1000	25	Along roadsides + adjacent gardens
	Emmen* (EM)	52°48' N 06°55' E	0.0053	80	25	Along roadside and deciduous forest edge
	Groningen* (GN)	53°13' N 06°35' E	0.1026	300	25	Alongside streets within town
	Hengelo (HO)	52°15' N 06°52' E	0.0495	700	25	Alongside paths in deciduous forest
	Kuinderbos (KB)	52°45' N 05°50' E	0.0071	175	25	Alongside deciduous forest path
	Ommen* (OM)	52°31' N 06°25' E	0.1238	2000	25	Alongside road and deciduous forest edge
	Oostvoorne (OV)	51°54' N 04°05' E	0.0141	200	25	Alongside deciduous forest path

	Winschoten (WS)	53°09' N 07°02' E	0.3127	200	25	Graveyard, mainly on old and poorly maintained graves
	Winterswijk (WW)	51°58' N 06°47' E	0.0311	500	25	Along roadsides, together with shrubs and few oak
Sweden	Billan (BIL)	60°39' N 17°30' E	0.3155	500	30	Herb-rich mixed coniferous forest
	Eggegrund (EGD)	60°44' N 17°33' E	0.4244	3000	15	Shingle beach and buckthorn thickets
	Gråsjälsbådan (GRN)	60°43' N 17°28' E	0.2688	1000	15	Shingle beach and buckthorn thickets
	Kyrkan (KYR)	60°38' N 17°24' E	0.0340	180	15	Gaps in herb-rich deciduous forest
	Lötängen (LOT)	60°36' N 17°25' E	0.2122	400	15	Gaps in herb-rich deciduous forest
	Lövgrund (LOV)	60°45' N 17°26' E	0.6225	1800	18	Shingle beach and buckthorn thickets
	South Utvalnäs (SUT)	60°45' N 17°20' E	0.1118	1060	45	Herb-rich deciduous forest
	Västanån (VAS)	60° 35' N 17°27' E	0.2405	400	15	Man-made river embankment

Table S2 A summary of empirical studies investigating between-population variation for dispersal ability in plants as a function of some measure of fragmentation or colonization history. V_t: terminal velocity; MDA: morphological dispersal ability.

	Conditions	Trait measured	Dispersal ability	Reference
Abrornia umbellata (Nyctaginaceae)	Natural	Wing index	- larger at both edges of the distribution	Darling *et al*., 2008
Acer rubrum (Aceraceae)	Natural	Wing-load ratio of samara	- decreases with increasing successional stage	Peroni, 1994
Carduus pycnocephalus and *C. tenuiflorus* (Asteraceae)	Natural	Proportion of seeds with a pappus	- decreases with increasing successional stage	Olivieri *et al*., 1985
Centaurea jacea (Asteraceae)	Natural	Predicted V_t and relative seed release height	-decreases with increasing population size for V_t, no effect for height	Soons & Heil, 2002
Cirsium arvense (Asteraceae)	Natural	Drop time and MDA	- smaller in island compared to mainland populations for both traits	Fresnillo & Ehlers, 2008
Cirsium dissectum	Natural	Predicted V_t and relative	- no effect of population size for any	Soons & Heil, 2002

(Asteraceae)		release seed height	trait	
Crepis sancta (Asteraceae)	Controlled	% dispersed seeds	- smaller in urban, fragmented environment	Cheptou *et al*., 2008
Epilobium angustifolium (Onagraceae)	Natural	Drop time and MDA	- larger in island compared to mainland populations for drop time but similar for MDA	Fresnillo & Ehlers, 2008
Epilobium hirsutum (Onagraceae)	Natural	Drop time and MDA	- larger in island compared to mainland populations for drop time but smaller for MDA	Fresnillo & Ehlers, 2008
Hypochaeris radicata (Asteraceae)	Controlled	Predicted V_t and plant flower stalk height	- decreases with increasing population size and inbreeding for V_t , no effect for plant height	Mix *et al*., 2006
	Natural	Predicted V_t and release height	- decreases with population size for plant height, no effect for V_t	Soons & Heil, 2002

	Natural	Pappus : achene volume ratio	- smaller in (old and larger) island populations compared to mainland populations - larger in island young populations	Cody & Overton, 1996
Mycelis muralis (Asteraceae)	Natural (Canada)	Pappus : achene volume ratio	- decreases with increasing population age on islands - smaller on mainland compared to youngest island populations, larger compared to older island populations	Cody & Overton, 1996
	Natural (Europe)	Observed or predicted V_t	-decreases with increasing fragmentation within Southern and within Central Europe - larger at the northern limit	Present study
	Controlled	Predicted V_t	- for the two populations studied,	Present study

			amount and direction of differentiation similar to that observed in natural conditions	
Pinus contorta (Pinaceae)	Natural	Wing loading, Seed size	- decreases with time since foundation	Cwynar & MacDonald, 1987
Succisa pratensis (Dipsacaceae)	Common garden	Predicted V_t and plant height	- increases with population size for height, no effect for V_t - no effect of inbreeding	Mix *et al*., 2006
	Natural	Predicted V_t and release height	- decreases with population size for V_t, no effect for height	Soons & Heil, 2002

Legends to Figs S1–S3

Fig. S1 Photograph showing flowerheads at various stages of development, as well as seed and pappus general morphology (photo: B. Giles).

Fig. S2 Map of the study landscapes.

Fig. S3 Mean V_t^{-1} (+ SE) values per landscape in each of the regions considered at the European scale.